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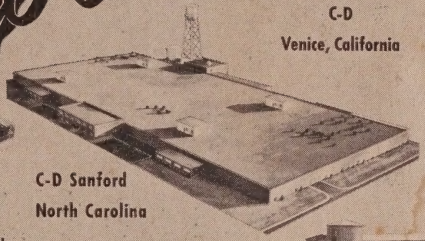

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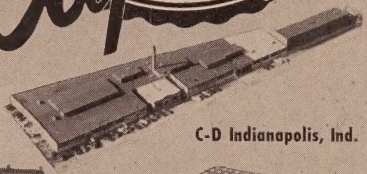

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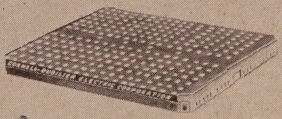

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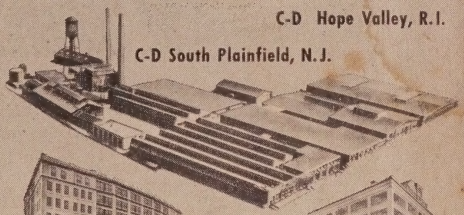

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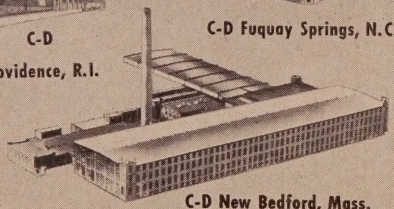

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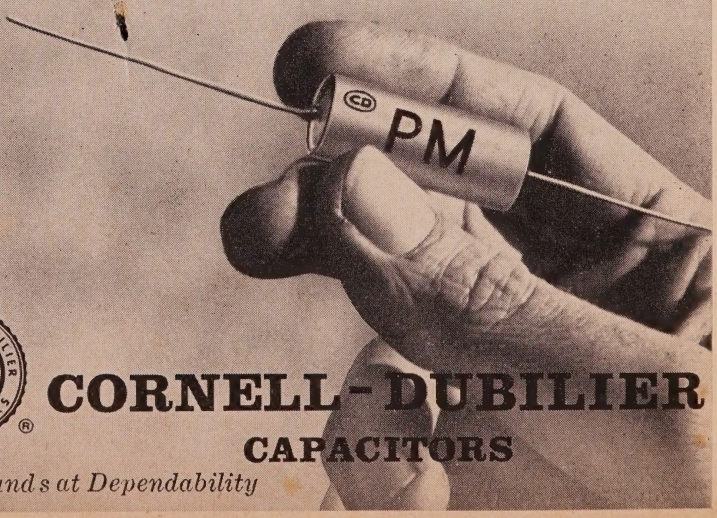

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Old Hands at Dependability

SERVICING TRANSISTOR RADIOS

Tranistorized radio receivers now are well established in the field. Several set manufacturers offer portable or personal receivers. By this time, some of the early models have received up to three years of use. Several home-type midget receivers are commercially available ready-made or as kits for private assembly. In addition, fully-transistorized auto radios are in use, as are also hybrid types (tubes in the low-level stages and power transistors in the audio output stage). At least one transistorized short-wave converter is on the market.

The consumer public is catching on to the advantages of transistorized operation: Instant service, small size and light weight, absence of heat, no power-line connections, long life with inexpensive batteries, freedom from hum and microphonics, and mechanical ruggedness. In transistorized auto radios, there are the additional advantages of direct operation from the car battery without vibrators, lower current drain than with tube-type sets, and longer periods of trouble-free operation.

The service technician may expect soon to be called upon to repair or adjust these sets. It is timely, therefore, to take note at this writing of the differences between tube and transistor sets and to outline the methods of servicing these new receivers.

Small Size Factor

One of the very first points to note is the size factor. The transistor is a subminiature component, and new types are being made progressively smaller. An impressive line of subminiature and sub-subminiature components have been developed to go along with transistors. These units include fixed capacitors, variable capacitors, transformers, coils, resistors, potentiometers, loudspeakers, crystal diodes, batteries, switches, and loop antennas. Designers have been quick to exploit the tininess of these components and to produce the first really practical miniature receivers. Getting in and around the circuitry and mechanism of these small sets requires tools less bulky than some of the smallest ones ordinarily used in working on conventional tube sets.

The technician will find that he can work better with the following pieces of equipment which may be foreign to his present tool box: Tweezers, forceps, fine-pointed soldering pencil, needle-nose pliers, midget diagonal cutters, scriber, set of jeweler's screwdrivers, set of needle-point files, and miniature insulated alignment tools. A jeweler's loupe also is recommended.

Since the small transistorized sets employ printed circuitry, any skill the technician may have acquired in working with printed circuit boards will be to his advantage.

Troubleshooting

Functionally, troubleshooting in a transistorized receiver does not differ from that in a tube set. However, the transistor and its circuits have some peculiarities which will modify test procedures to some extent.

To begin with, the transistor is a resistive device. Its input is a resistance, and so is its output and also the internal path between output and input. A tube has input and output resistance components too but they disappear when the power is shut off. In a tube circuit, many continuity tests can be made if the operating voltages first are switched off. Not so in a transistor circuit — the resistance path remains and, in addition, is unilateral. In some transistor circuits, it is impossible to make a

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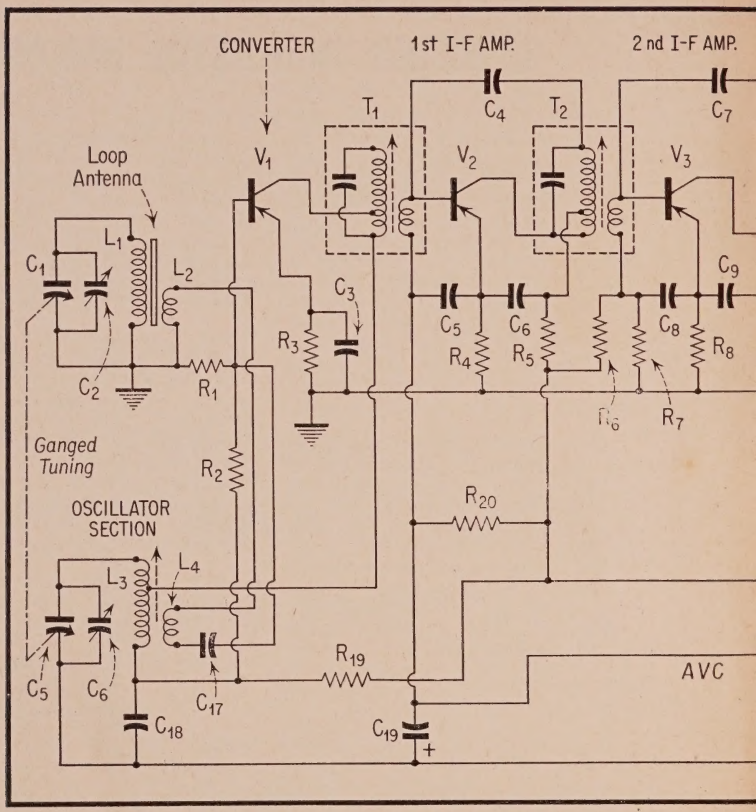
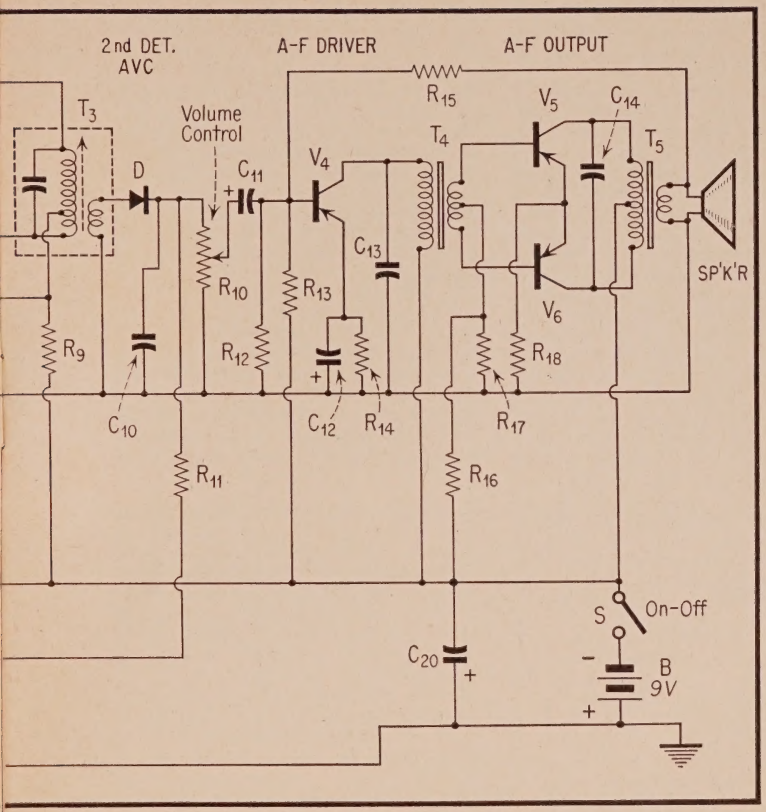


Fig. 1. Typical Transistorized Superheterodyne Receiver.

continuity test without removing the transistors completely. In some instances, the transistor might even be damaged by current from the ohmeter.

Figure 1 shows a transistorized superheterodyne circuit of the type used in many receivers. The stage functions are the same as in a tube receiver. Transistor V_1 is the combined oscillator and mixer, V_2 the 1st i-f amplifier, V_3 the 2nd i-f amplifier, diode D the 2nd detector and avc rectifier, V_4 the a-f driver, and V_5-V_6 the pushpull Class-B a-f output amplifier. Signal pickup is provided by a high-Q ferriterod antenna of which L_1 is the antenna winding and L_2 a smaller, inductively-coupled secondary to match the low input impedance (of the order of 1000 ohms) of the converter transistor, V_1. Inductor L_3 is the oscillator coil which has an r-f output winding, L_4.

The transistors are connected in the common-emitter configuration; that is, base-input and emitter-grounded. This



is roughly equivalent to the well-known grounded-cathode tube. The base electrode of the transistor is equivalent, in this application, to the grid of the tube, the emitter to the cathode, and the collector to the plate.

The i-f and a-f transformers have a stepdown ratio for matching the collector impedance of one stage to the lower base impedance of the following stage. This is an important point to remember when tracing a signal voltage through the transistorized receiver, since a voltage stepdown normally will be observed between the output of one stage and the input of the next. Thus, circuit points which the technician customarily has recognized as high-impedance in tube circuits (such as the grid input) are low-impedance in the equivalent transistor circuit. This is reasonable when it is considered that the transistor is a current-operated device and its basic function is to provide power amplification (although it secondarily provides voltage amplification), while the

vacuum tube is a voltage-operated device. The oscillator coil also has a stepdown ratio between L_3 and L_4.

The tube is not affected severely by temperature changes, while the transistor is. Also, tubes may be interchanged with others of the same type without drastically upsetting the operation of most circuits, while this is not universally true with transistors. Fortunately, shift of the d-c operating point with temperature and as the result of transistor replacement may be minimized by stabilizing the operating point with stiff voltage dividers. Thus, the d-c base voltage and the d-c operating points are stabilized in the circuit in Figure 1 by voltage dividers R_1-R_2, R_6-R_7, R_{12}-R_{13}, and R_{16}-R_{17}, and by emitter resistors R_3, R_4, R_8, R_{14}, and R_{18}. These latter resistors are equivalent roughly to the cathode resistor in a tube circuit. The presence between base and ground of one resistor of the voltage divider clearly would make impossible the checking of the transistor input resistance. For example, voltage-divider resistor R_{12} shunts the input of transistor V_4.

Another important point of difference, imperative to remember in troubleshooting, is the polarity of the d-c operating voltage when PNP transistors are used as in Figure 1. That is, the output (collector) voltage is negative with respect to ground, while the technician has habitually seen the output (plate) of tube circuits as positive. The polarity of electrolytic capacitors in the circuit therefore appears to be backward. (See C_{11}, C_{12}, C_{19}, and C_{20} in Figure 1.) When NPN transistors are employed, the polarity of d-c voltages and capacitors is reversed and becomes the same as in tube circuits.

The i-f amplifier stages are neutralized, by means of fixed capacitors C_4 and C_7, to prevent self-oscillation. This feature is not found in tube circuits for the reason that screen-grid tubes are employed. The transistors, being triodes, have no such screening electrode and are subject to oscillation in high-gain circuits of this type.

The volume control potentiometer, R_{10}, must be dc-isolated from the base of transistor V_4, otherwise it will change the d-c bias of this transistor as the potentiometer resistance is varied to change the volume. Capacitor C_{11} provides this isolation; but, since this capacitance must be high to pass low audio frequencies into the low-impedance V_4 input circuit, C_{11} is an electrolytic.

The foregoing are the important respects in which the transistor circuit differs from a tube-type superhet. In other particulars, the two circuits are reasonably similar. The differences require certain modifications of approach in troubleshooting procedures, as detailed in the following discussion.

Basic Test Procedure. Good transistors have long life, are mechanically rugged, and usually are not the cause of trouble in well-designed receivers. A bad transistor, such as one in which collector current drifts upward, can cause trouble. Since transistors operate at low d-c voltages, the resistors associated with them seldom burn out. Most of the time when a set has acted up, the trouble will be found in a worn or disconnected battery, broken connections, an open circuit in one of the a-f or i-f transformers or volume control (these tiny components being wound with very fine wire which has small current-carrying capacity), or in damaged subminiature electrolytic capacitors which have been operated too close to their maximum d-c working voltage and have had to withstand peak signal voltages as well.

As in checking tube sets, a quick visual inspection first should be made to spot obvious troubles such as a disconnected battery, loose or mechanically-damaged components, and broken printed circuitry. These defects should be corrected immediately and sometimes are the only trouble present. Next, the battery voltage

should be measured under full load. Since there might be a short circuit in the receiver, it is best to remove the battery and make the voltage test with a load resistor connected in parallel. Select the resistance such that the current drain is 30 to 50 ma and replace the battery if its voltage has dropped below 65% of rated value.

When checking a tube set, the next step customarily would be to test all the tubes, replacing any defective ones. There are two reasons for not following this procedure in transistor circuits. The first is that transistors are most often not defective. The second is that the transistor must be removed from the circuit for testing and may be damaged by the heat of the soldering iron. Hence, it is better not to unsolder their pigtails unless all evidence from other electrical tests points toward transistor trouble. If the battery is good, a test signal should be injected at various circuit points, starting with the speaker and working back to the antenna, to determine which portion of the circuit is inoperative. When the first faulty stage is located, d-c voltage tests then may be made to isolate the possible cause of the trouble. In all testing of the receiver, leave the speaker connected to the circuit or, if a quiet test must be made, substitute an equivalent load resistor.

Signal Injection. This test operation is carried on in the conventional manner. Use an r-f signal generator as the source of r-f and i-f test signals, and an audio generator for af. Many service-type r-f oscillators have a 400-cycle output which will supply the audio signal. It is important to re-

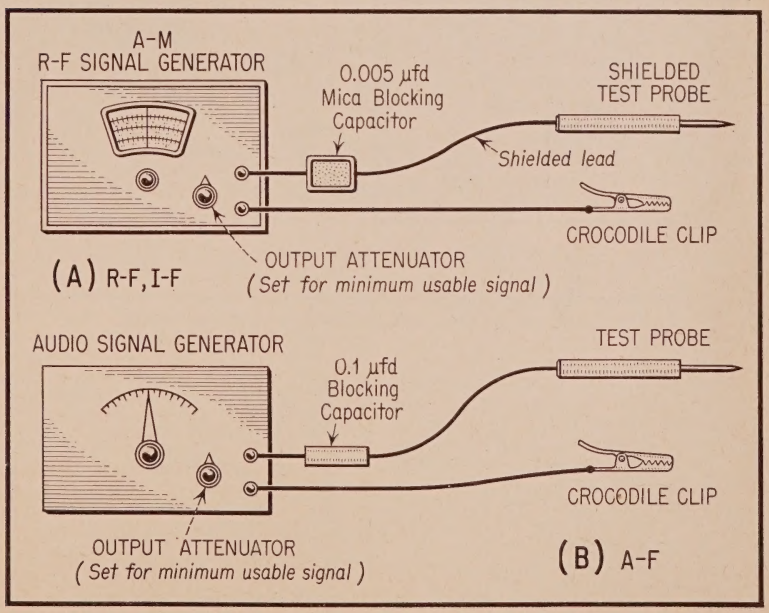


Fig. 2. Signal-Injection Instruments.

member that the injection points in a transistorized circuit have lower impedance than comparable points in an equivalent tube circuit, and the attenuators of the signal generators may need to be set higher. At all points, however, unless advised otherwise in the test instructions, use the minimum signal amplitude for a clearly audible signal. This will prevent overloading.

The output circuit of the generator must contain a blocking capacitor. If such a capacitor is not present, the output attenuator of the instrument will short-circuit the transistor circuit. Thus, if a non-blocked generator were connected between ground and the top of the secondary of i-f transformer T_2 to inject a signal into the 2nd i-f stage, the output attenuator would short-circuit the secondary and also resistor R_7. Shunting R_7 in this fashion would shift the d-c base bias and operating point of transistor V_3. Figure 2 shows how the generators should be arranged for signal injection.

In Figure 1, the a-f signal would be injected first between ground and the top of the secondary of T_5. If the signal is heard in the speaker, inject the a-f signal next between ground and the top of the primary of T_4. This will check T_4, T_5, and the Class-B output stage. If the signal is still heard, inject between ground and the top of C_{10} to check volume control R_{10}, coupling capacitor C_{11}, and the a-f driver stage. If signal still is present, inject a 455-kc (or other i-f) amplitude-modulated signal between ground and the top of the T_3 primary to check T_3 (condition and alignment) and diode D. If signal still is present, inject the a-m i-f signal between ground and the top of the primary of T_1 to check the entire i-f amplifier. If the signal still is present, an r-f test signal (amplitude-modulated) should be injected at the antenna to check operation of the converter stage. Figure 3 shows how a miniature, transistor-type loopstick antenna may be connected to an a-m r-f signal generator for inductively coupling the signal into the loopstick antenna of the receiver. Place the test loopstick close to the receiver antenna and set the at-

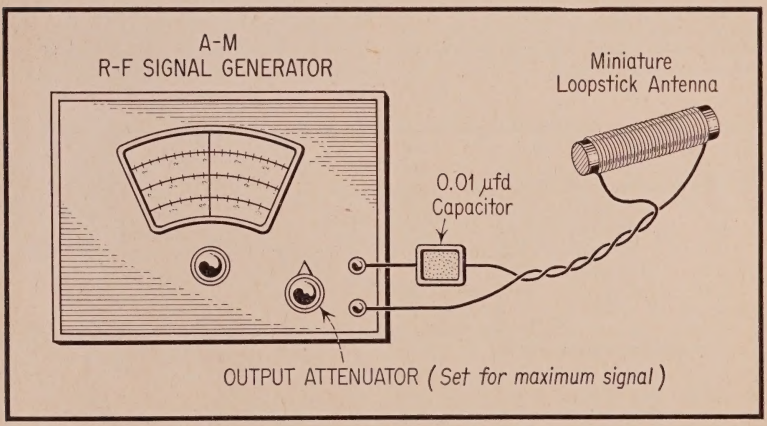


Fig. 3. Setup for Inductive Coupling of R-F Test Signal.

tenuator of the generator for maximum signal amplitude. Tune the receiver and generator to the same carrier frequency.

Loss of the signal at any of the foregoing test points may indicate either a faulty transistor or diode, a defective circuit component, incorrect d-c voltages, or misalignment of the i-f or converter stages. The i-f transformers are slug-tuned, the mixer stage is aligned by means of trimmer capacitor C_2, and the oscillator is trimmed by C_{16} and the tuning slug of oscillator coil L_3.

Signal Tracing. Some technicians prefer signal tracing to signal injection, although each of the two methods achieves the same end result. In signal tracing, use the amplitude-modulated r-f signal generator setup shown in Figure 3 to couple the test signal inductively into the receiver. Then employ a sensitive a-c vtvm to trace the signal through the various stages in the conventional manner, working from the antenna through to the loudspeaker. At all test points between the antenna and the input to diode D, an r-f probe must be provided for the vtvm unless the frequency response of this instrument extends to about 2 Mc. From the output of diode D to the loudspeaker, the r-f probe (or high frequency response) is not required. When the test signal is found at the input of the converter stage but does not pass into the i-f amplifier, the oscillator stage probably is not operating. To check the oscillator, connect the r-f vtvm between ground and the stator terminal of tuning capacitor C_{15}. An r-f voltage will be detected if the oscillator is functioning and will be fairly constant over the tuning range.

Checking D-C Voltages. When a faulty stage is located by means of either signal injection or signal tracing and (in r-f, oscillator, and i-f stages) the trouble is found not to be caused by misalignment, check the d-c voltages wih a d-c vtvm. If a voltage is absent or if it differs markedly from the set manufacturer's test data, an examination of the circuit diagram usually will give a clue as to which component might be faulty.

In each stage, the emitter-to-ground voltage of the transistor should be closely equal to the base-to-ground voltage. Collector voltages will be somewhat lower than the voltage of battery B. The collector voltage of the Class-B a-f output stage will swing between a zero-signal value close to the battery voltage, and a low, maximum-signal value. The correct values of all the d-c voltages should be ascertained from the set manufacturer's service literature. AVC voltage may be measured between ground and the cathode of capacitor C_{19}.

Since the resistors and transistors seldom are the cause of trouble, the absence of voltage often is due to an open transformer winding. Incorrect voltage usually is apt to be caused by the shunting effect of a short-circuited or extremely leaky electrolytic capacitor, such as C_{11}, C_{12}, C_{19}, or C_{20}.

Continuity and Leakage Testing. Continuity testing, in the conventional manner, is virtually impossible in the transistor circuit because of the ever-present resistance paths provided by the transistors themselves. When a transformer is suspected of open circuit, a resistor or changed value, a capacitor of high leakage, or a diode of poor front-to-back ratio, at least one lead of that component must be unsoldered from the circuit before an ohmmeter check can be made.

Even when the component is removed from the circuit a d-c continuity test of an a-f or i-f transformer is inconclusive except when an open-circuited winding is found. A conventional a-c signal test also should be made to ascertain that the transformer is operating correctly and that its windings are not short-circuited at least partially.

Current Measurement. In some in-

stances, it may be desirable or even necessary to measure direct current levels in the circuit. In printed circuitry, it is not easy to open a line for the insertion of a milliammeter for this purpose. The only practical method in such a case is to unsolder one lead of a component in the line and to insert the meter in series.

Currents should be measured under both zero-signal and maximum-signal conditions. A milliammeter inserted in one of the battery leads will indicate the total drain of the set, which for a circuit of the type shown in Figure 1 will be approximately 10 ma zero-signal and 36 to 40 ma maximum-signal. In a receiver having a single-ended Class-A output amplifier, this large current swing is not present. When the meter is inserted in the center-tap line of transformer T_5, the Class-B (V_5-V_6) collector current alone is indicated. This current has a zero-signal value of approximately 1 to 2 ma and a maximum-signal value of 20 to 25 ma in a receiver having a power output of 100 to 125 milliwatts. In a Class-A output amplifier, such as found in some of the headphone-type transistor receivers, the collector current is of the order of 10 to 25 ma and should be steady under both zero-signal and maximum-signal conditions.

Audio Distortion. Because of the small size of the loudspeakers in transistorized receivers, sound reproduction is these sets does not have the wider range and higher fidelity afforded by larger reproducers. Furthermore, harmonic distortion sometimes tends to run slightly higher in transistorized audio power amplifiers than in tube amplifiers having the same power output.

Precautions are taken in the circuit design to keep this distortion low. For example, in Figure 1, negative feedback is provided through resistor R_{15}. The common emitter resistor, R_{18}, is left unbypassed for further degeneration. Also, the d-c base bias provided by the voltage divider, R_{16}-R_{17}, minimizes crossover distortion which otherwise might be severe in the Class-B stage. A further advantage is obtained through the matching of transistors V_5 and V_6.

When distortion appears to be excessive, the technician should check transistors V_5 and V_6 for matching of collector current, i_{cbo}, and beta. An oscilloscopic examination of the output-voltage waveform will show up crossover distortion and point up trouble in the R_{16}-R_{17} network. The feedback resistor, R_{15}, also should be checked for resistance and for connection in the circuit. Finally, the loudspeaker should be inspected for loose parts or rubbing voice coil and replaced if defective.

Special Precautions. When high-frequency r-f transistors (such as surface-barrier types) are employed, as in transistorized short-wave converters, keep the r-f test-signal amplitude low. Do not use a power-type test oscillator. Extremely thin wires are used inside these transistors and they can be fused open by strong r-f currents.

A few transistorized receivers employ reflex circuits. Due to the peculiarities of this type of circuit, the volume never can be reduced completely to zero. This is a normal condition for such sets and does not indicate trouble. In some reflex circuits, there is a tendency, also unavoidable, toward slight oscillation at the high-frequency end of the tuning range. This gives rise to faint "birdies" on the station carriers in the upper quarter of the dial.

When making an on-the-air check of a receiver operated from its self-contained antenna, remember that most of these antennas are very directional. Unless the antenna itself is rotatable, the entire set must be turned horizontally for maximum pickup. Strong stations sometimes can be nulled out completely within a very small arc of rotation. This effect is especially pronounced when the stations are located

at some distance. A set might give every indication of being dead until it is turned around a few inches.

Testing Transistors. If after performing signal and voltage tests, transistor trouble is suspected, the transistor in question must be removed from the circuit and tested. Removal requires the utmost care to protect the transistor and the printed circuit from heat damage. (Some sets have subminiature sockets to hold the transistors and thus offer no problem, but in most sets the transistors are soldered in). Use a pointed-tip soldering pencil. Hold the transistor pigtail with long-nose pliers which serve to remove the heat. Continue to hold until the pigtail has cooled. Work as rapidly as possible.

After the transistor is removed, check it in a transistor tester. If a tester is not available, use the circuits shown in Figure 4. Use 4(A) first and then 4(B). The setup shown in Figure 4(A) checks leakage current and drift: Close switch S and note the reading of milliammeter M. This deflection shows the static leakage current, i_{cbo}, which should have a value of less than 0.125 ma in a good transistor. (See transistor manufacturer's literature for rated value). This current increases with temperature. Keep the switch closed for a few minutes, observing if the current creeps or jumps. Creepers should be replaced.

If the transistor passes the first

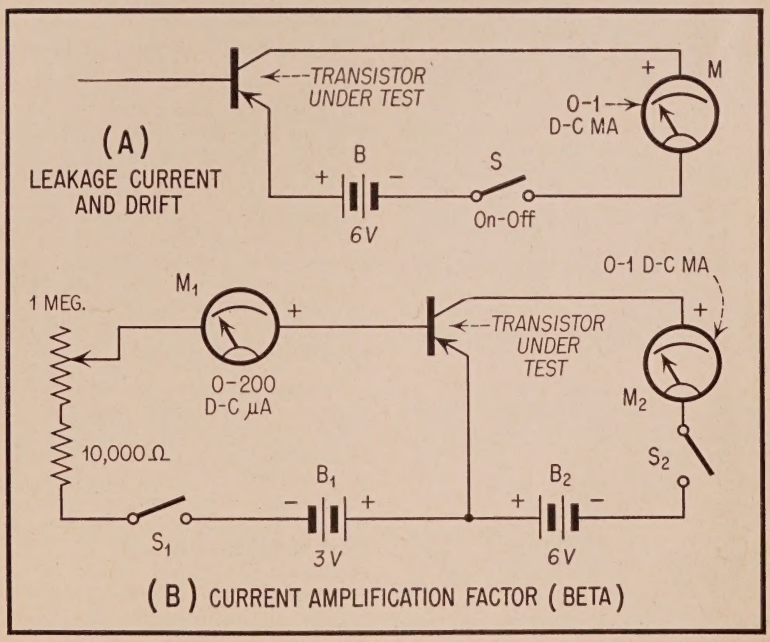


Fig. 4. Transistor Test Circuits.

test, connect it in the circuit shown in Figure 4(B). This circuit tests the current amplification factor, beta. First close switch S_2 and record the deflection of milliammeter M_2 as I_1 (in ma). Then, keeping switch S_2 closed, close switch S_1, noting that the deflection of M_2 increases. Record the new reading of M_2 as I_2 (in ma). Record the reading of microammeter M_1 as I_3 (also in ma). Calculate the value of beta from: $(I_2—I_1)/I_3$. The correct value may be obtained from the transistor manufacturer's literature. Beta is between 10 and 50 for small transistors. Replace the transistor if beta has fallen to 70% or less of rated value.

The current values will be much higher for power transistors such as are used in the audio output stage of a transistorized auto radio. Leakage current measured in the test circuit in Figure 4(A) may be of the order of 1 ma. In the test circuit of Figure 4(B), M_1 should be a 0-1 d-c milliammeter, and M_2 a 0-1 d-c ammeter. In the beta test, the collector current will increase to a value of 500 ma or higher.

Polarities in the test circuits as shown for PNP transistors. When testing NPN transistors, reverse each battery and meter.

Repairing

It was stated earlier in this article that certain small-sized tools will be advantageous in the repairing of transistorized radios. The technician will find that he can augment the suggested list with still other tools and gadgets which will make it easier for him to work with the small components and compact circuitry in the close spaces of these receivers.

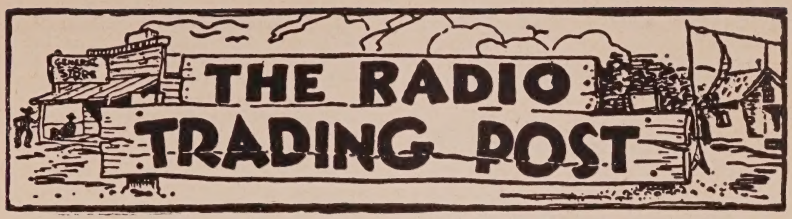
A small, pointed-tip soldering pencil is superior to a soldering gun for work in printed circuits because of the former's more even heat. A 25-watt pencil is about right. Too much heat is damaging both to the printed wiring and to the transistors.

When replacing transistors, use the pigtail holding scheme described in the previous section and do the job as rapidly as possible. Always replace transistors with identical types. In the pushpull Class-B stage, the transistors may be matched for minimum distortion and should be replaced only with such a matched pair. When replacing power transistors, be careful to replace correctly all insulating washers and heat-sink parts. Power transistors must be bolted solidly to the chassis or heat sink.

In receivers employing PNP transistors, the polarities are apt to be confusing to the technician who is accustomed to tube circuits — positives and negatives seem to be interchanged. Thus, electrolytic capacitors have their cathodes grounded in tube circuits while in the transistor circuit (Figure 1) replace C_{12}, C_{19}, and C_{20} with their anodes grounded. The polarity of C_{11} also is important. To prevent malfunctioning or even burnout, be careful of the polarity of the battery, all transistors, all replaced electrolytics, and diodes.

Transformer polarities also are important. When making replacements, follow the lead color coding of the original unit or oscillation may result. If the secondary of T_5 in Figure 1, for example, is reversed, the feedback through R_{15} will be regenerative instead of degenerative, and the audio amplifier will oscillate. If one of the i-f transformers is reversed, capacitors C_4 and C_7 no longer will provide neutralization and the i-f amplifier will oscillate.

When replacing a volume control, use a potentiometer identical with the original. Some sets employ a special transistor taper which provides even control of volume over the entire rotation. If this taper is not duplicated in the replacement, the control action will be "hair-trigger" near the low end.



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SWAP OR SELL — Modulation transformer, 811's to 813, pair 813's, input transformer, 6N6 to 811s, split stator variable cond. C. M. Lalloz, 2625 Fix Rd., Grand Island, N. Y.

FOR SALE — Garrrd RC-80 three-speed record-changer, two spindles, base, magnetic cartridge, $35; Revere 16 mm movie camera, magazine, rotary shutter, 5 speeds, Wollensak F:1.5 focusing-mount lens, $115; Shure 737A microphone, $20. All FOB. Marilyn Phillips, 311 Penfield, Rockford, Ill.

FOR SALE — WE 1086-B theatre amp. and ERPI power unit TA4144A and TA738 monitor, $75; WE MG set 18 v. 21 amp. DC, $30; 6 v. battery charger, 150 amp. MG set, $45. M. Nederostek, 848 Walnut, Allentown, Pa.

FOR SALE — NRI sig. tracer; 20 assorted TV and Radio books, $10. Want drill-press, jig saw, bench saw, sander, planner, grinder with or without motors. Will trade or pay cash and pick up at 100 miles radius. Earnest Beard, R 1, DeMotte, Ind.

FOR SALE — Precise 111 tube tester with built-in sig. tracer equiv. to Eico 147 and CRT adapter, $97.50. Perfect cond. N. Round, 29 Elmwood Rd., Methuen, Mass.

FOR SALE — EMC stacked stereo player, amplifier, speaker cabinet, plus transistor pre-amp to connect to radio or phono for second channel, $49.95; Bogen variable speed record player, $24.50. J. C. Davis, 9014 N. Laramie Ave., Skokie, Ill.

WANTED — ARC R-13B, 15, 19, 22, VHF and B-10, B-13 omni converters; ARC T-11B, 13A, 20, 23 VHF xmitters. Advise price, cond. Bill Slep, Box 178, Ellenton, Fla.

WANTED — 2 DX-100 xmitters in good operating cond. Will pay $100 each. CASH! Roy E. Becker, 106 So. Carbon St., Marion, Ill.

WANTED Mobil xmitting and receiving equip. at reasonable prices. William Bliss, 3420 Louisa St., Pittsburgh 13, Pa.

SELL OR TRADE — ½ KW power supply, variac controlled, 0-2300 v. DC, metered output, rack mounting; assorted ham gear. Want Ballantine 300 or 314 VTVM or quality audio oscillator. A. R. Hanson, Staff House 17, Rosemount, Minn.

FOR SALE — Ten-station intercom master, $17.50; B-J tangential phono arm, $17.50; Brush Soundmirror tape recorder, $75; components belt-drive turntable, $75. V. R. Hein, 418 Gregory, Rockford, Ill.

SWAP — DeVry home study course for TV rotator, ham gear, and ?, no cash. D. McCrummen, Rt 2, Box 318, Eagle Pass, Tex.

STOLEN — Pentron tape recorder model T-90, serial no. 8098. Reward for information leading to recovery. Experimental Research Lab., 62 Broad St., Albany 2, N. Y.

SELL OR TRADE — B & J press camera, 4 x 5 with Heiland gun, case, etc.; Harvey 542 150 Mc FM mobile xmitter and rcvr., 6 v.; BC-683 12 v. 30-40 Mc police rcvr. Mort Bardfield, 4 Brinsley St., Boston 21, Mass.

FOR SALE — Heathkit VTVM expertly assembled, used 3 times; RTTS Radio and TV course with or without kits in excellent cond; unused complete photo developing and printing kit. John Ellison, 934 Radcliffe Rd., Towson 4, Maryland.

WANTED — Manual for Army Sig. Corp. tube tester No. 1-177. Advise price. George Klamet, 1605 Ardoyne Ave., Cleveland 9, Ohio.

WANTED — Pilot 3" TV sets model TV-37U. Any cond. acceptable. Schauer Radio & TV Service, R 2, Paw Paw, Mich.

FOR SALE — Riders TV manuals, 1-8. First $50 money order takes them. Fair cond. I. Horowitz, 1775 East 17 St., Brooklyn 29, N. Y.

WANTED — Supreme radio diagrams since 1947 to date, used TV and radio sets, record players, part. Send list. R. M. Massey, 423 Monroe St., Philadelphia 47, Pa.

WANTED — High-band (ch. 8-12) antenna mounted or set mounted boosters. State price, cond., full details immediately. J. J. Mueller, Manchester, Vt.

SELL OR TRADE — GE sig. gen. YGS-3. Need Hi-Fi amp 10 w. in good cond plus speakers or what have you? Bill Leigh, 1311 Peach St., Lincoln, Neb.

FOR SALE — Lab model 202 Hickok VTVM, good cond., $19 plus postage. C. H. Dietz, 1421 Harris St., Gainsville, Texas.

TRADE — 35 mm German I Loca slide camera with filters, light meter, flash attachment, and rangefinder. Want good metal locator. Charles Westing, 3816 Sixth Ave., Des Moines 13, Iowa.

TRADE OR SELL — Hearing aid, xmitter tubes, and metal locator for transistors, diodes, small parts for transistor radios. John Haynes, Doe Run, Mo.

WANTED — Operating instructions for 510X Hickok tube checker. Henry Edwards, 628 Millville Oxford Rd., Hamilton, Ohio.

WANTED — 20 w. Universal amplifier 6-12 VDC; 2 re-entrant trumpets 19" bell with 25 w. drivers for PA sound truck. Bob's TV Service, Box 37, Wabasso, Fla.

WANTED — Will pay $13 for Sams manuals CM-1, AA-1, 2 and 3 in good cond. Stan Farmer, P. O. Box 150, Grand Junction, Colo.

TRADE — Eico batt. elim. 1050K for 20K per volt multimeter. Edward Sulzbach, 5819 Newtown Ave., Philadelphia 20, Pa.

WANTED — Used 1957-58 Plymouth radio in any cond., also Precision tube checker such as 920, 912. State cond. and lowest price to sell. Jim Wong, 1475 Shotwell St., San Francisco 10, Calif.

WANTED — Information on conversion of a BC-1033 rcvr. for radio controlled garage door operation, or will purchase Army Tech. Manual on above rcvr. Theodore M. Korch, 612 Sycamore St., Rahway, N. J.

WANTED — FM rcvr. 30-40 Mc. Will trade 4-110 VAC brass encased selsyns plus 10' trylon tower self supporting. Art Bonte, 3138 Kingsbridge Ter., Bronx 63, N. Y.

WANTED — Communications rcvr. National HRO-7 or equivalent; code practice records. Both in good cond., reasonable. R. W. Masters, 351 Twin Lane South, Wantagh, N. Y.

FOR SALE — TVI'd Collins 32V2, $325; 500 Ma 1500 v. power supply, $50· Millen SWR bridge, $8.50; 100 TV sets, $9 up, color TV, $125. Ship anywhere. Justis, Box 3145, Newport, Del.

WANTED — Schematic diag. and tech. information on Aireon 1221A audio amp. and 1223A power supply control panel as used in juke box. Larry Dillin, 10431 Hillhaven, Tujunga, Calif.

WANTED — Heath mod 7D or 7E, 7 watt amplifier in new cond. T. Ferguson, 171 E. 91 St., New York 20, N. Y.

FOR SALE — Like new RMS bar gen. mod. BAR-1. Best offer. Williamson Radio Service, 631 W. Dallas Ave., Cooper, Texas.

TRADE — Complete relay banks and mechanism from pin-ball machine less cabinet, in good used cond. John O. Hehn, 18 S. Jardin St., Shenandoah, Pa.

FOR SALE — Unused Bud FCC-90 100 kc calibrator, $15 FOB. William Emmons, 16 Laurel Ave., Bordentown, N. J.

FOR SALE — Heath TC-2P portable tube tester with TV picture tube adapter and acorn socket in excellent cond., $45; old Philco 7050 tube tester, $25. Michael Bilgrei, 146 Hewes St., Brooklyn 11, N. Y.

WANTED — Instruction manual or schematic for National RCL or RCK communications rcvr. M/Sgt. Clyde L. Mings, 57th Ftr. Intcpt. Sqdn., APO 81, Postmaster, N. Y.

WANTED — Direct reading frequency meter built and calibrated as described in 1957 "Capacitor." Must go to 100,000 cycles. Trade test equip. or cash. R. N. Eubank, 1227 Windsor Ave., Richmond 27, Va.

WANTED — Surplus BC455 rcvr., tunes 7-9.1 Mc., must be in good to new cond. Local preferred. Robert Sandberg, 2402-65 St., Brooklyn 4, N. Y.

FOR SALE — NRI multitester, AC powered, complete with AC-RF head. Best offer. John Strazza, Jr., 48 Pulaski St., Bloomfield, N. J.

FOR SALE — Two 222 transceivers freq. range, 27 to 54 Mc. in excellent cond. with batteries, $50. John Erdman, Webster, S. D.

FOR SALE — Meissner 18 tube AM-FM tuner, $50; polic-alarms, 30-50 Mc., and 152-172 Mc., $30 each. G. L. Sweigart, 12 Sycamore Rd., Ephrata, Pa.

SWAP — Radio and TV test equip. for rifles, pistols, shotguns, reloading equip. William Bockman, 400 Single Ave., Collins Park, New Castle, Del.

WANTED — Antenna coupler or tuner; Heath AC-1, or ? Have Superior super meter and cash. Stanley Buckwalter, 61-41 Saunders St., Rebo Park 74, N. Y.

WANTED — Power tran RCA with number 61730, under this in box "AB2-1." Unit is in rectangular steel case with Hi volts windings and two 2½ volt heater windings. Bob Beard, P. O. Box 516, Hayfork, Calif.

WANTED — VTVM; Sams Photofact folder 71; flyback xformer RAM XO99; Farnsworth Capehart 850220, 850285. flyback for Covideo No. FCO A111; ICA Universal cutting tool No. 80, 7/16 to 3" or equivalent. M. E. Turk, Rt. 2, Box 182A, Harrah, Okla.

SWAP — For ham gear or 16 mm equip., model 12 RTTY Dumont 5" scope RDZ-1 Navy rcvr. Leo Meister, 321 River Rd., Nutley 10, N. J.

FOR SALE — Chicago power transformer. Pri. 117 v., 60 cy., sec. 550 v., 50 Ma., no CT; 12.6V, 1A; 6.3VCT, 1A; 6.3V, 1A; hermetically sealed case, $3.50 postpaid. R. H. Denton, 1422 West Little Creek Rd., Norfolk 5, Va.

WANTED — Heath IB-2 impedance bridge and blank calibration book for BC-221 or LM freq. meter. Cash or swap G.R. Precision condenser; Gonset Super-6 converter; Eico R/C bridge; Silver 909TV sweep gen. H. R. Boone, 11311 Mercedes, Detroit 39, Mich.

FOR SALE — Portable 2-meter beam, 3 element, horiz. and vertical operation, with stand and cable, for Gonset rig, indoors or field. Excellent performance, $15. M. G. Weiman, 4514 Ave K, Brooklyn 34, N. Y.

SWAP — 6 v. wire recorder, with lots of wire, suitable for use in mobile applications. Want 35 mm or larger size camera. Karl Neuwirth, 16 May Pl., Nutley 10, N. J.

SELL OR TRADE — Recent DeVry Radio-TV course, complete, less kits, cost $385. Best offer over $50, plus postage. J. C. Mallett, 2146 Donner Ave., Fresno, Calif.

WANTED — Low priced test equip. First letter state price, details, if manual and schematic are included. R. B. Johnson, 3922 W. 108 St., Inglewood, Calif.

WANTED — 10 or 15 watt amp. in trade for 25 shot, .22 cal. rifle, 4X scope, sling, very accurate. Bill Hagars, Box 305, Slicksville, Pa.

SELL OR TRADE — Heath VF-1 VFO, $15, or good 6 m. converter. Howie Fine, 67-19 172 St., Flushing 65, N. Y.

FOR SALE — Gonset 6 v. 2-meter communicator II, excellent, $145; Trav-Electric dual converter M5585, 110 v. at 75 watts, 6 v. input and 110 v. at 110 watts with 12 v. input, $22. R. Champlin, Jr., 31 Ox Bow Lane, Summit, N. J.

FOR SALE — PE-103 dynamotor, $15; BC-699T1 126-146 Mcs VFO xmitter and Simpson 260 VOM, $20 each; Dumont 164E scope, $30; C-D dual power supply 6-12 VDC, $15; 6" square Weston 0-10 AC ammeter, $10. Charles Elmitt, Box 97, R 4, Loveland, Ohio.

FOR SALE — Eico 625 tube tester l. n., $35; 460 scope, $50; 352 bar gen., $12; Jackson 640 sig. gen., $20; Philco 7030 sig. tracer, $20. Ayres TV Service, 945 Midland Ave., Syracuse, N. Y.

SELL OR TRADE — Gonset 10m converter; 10 m beam; 32v Delcolite plant; 6v dynamotor; Waterman pocketscope; 110v inverter; Keystone 16 mm projector; Bubble sextant; Mercury 35 mm camera; 10m Master mobile whip. What have you? J. Leeb, 549 Green Valley, Paramus, N. J.

FOR SALE — Collins 32 V-2 xmitter with spare final tube. Sacrifice $290, plus shipping. M. Levy, 9104 Roanoke, El Paso, Texas.

FOR SALE — 3 Hallicafter Littlefones, portable 2-way radio-telephones 25-54 or 144-220 Mc, cost $400 each. Make offer. H. F. Raley, 1452 S. Lafayette St., Denver, Colo.

FOR SALE — Crystals: 1000 kc., $2.50; 200 kc., $1.50; 1000 kc. for BC-221 frequency meter, $4.50. E. P. Sadler, 398 Sigourney St., Hartford, Conn.

SELL OR TRADE — Supreme push button 504B super-tester, clean, makes all tests, needs some repair, no filament volts. Will sell cheap or trade for late tube tester. W. F. Onder, R 2, Box 379, Arnold, Mo.

SELL OR SWAP — Unused 10M beam Elincor 400EA; PE-103A and other ham items for 16Ga, Remington Sportsman, 38 Colt automatic, for what have you? Mel Lawson, 4010 River Dr., Houston 17, Texas.

FOR SALE — Ampex Stereophonic A-122-SP outfit, hardly used, recorder and 2 speakers in beautiful luggage-type carrying cases. Guaranteed perfect. Will ship in factory cartons at $200 less than cost. Al Caggiano, Bridgeton, R 2, N. J.

FOR SALE — Knight Ocean Hopper rcvr., complete with 6 coils, cabinet, and built-in speaker, no phones, 155 Kc to 35 Mc, good cond., $10. George Snyder, 900 E. Arcadia Dr., Pittsburgh 37, Pa.

WANTED — Heath A0-1 audio gen. W. Richman, 40-01 Little Neck Pkway, Little Neck 63, N. Y.

WANTED — 6SD7GT tubes for cash or trade equip. Also late model mine detector. State exact cond. Laurel Keene, 2542 Bellewood St., Ann Arbor, Mich.

SELL OR SWAP — Precision 920 tube and set tester, $40; McMurdo-Silver 900 sweep gen., $30; EMC VOM, $20; in-circuit cond test, $12; Eico: cap.-res. bridge, $20; 315 sig. gen., $25 and 7" scope, $60. Control, 123 Ave. U, Brooklyn, N. Y.

FOR SALE — Amplifier Corp. Twin Trax tape recorder transport, $25; blonde finish bass reflex 6 cu. ft. speaker cabinet, $25. Bernard Engelson, 621 Ave. Z, Brooklyn 23, N. Y.

WANTED — Sams complete Photofact folders. State numbers and price. J. Lowenthal, 3531 Cliftmont Ave., Baltimore 13, Md.

SELL OR SWAP — RCA UHF-710 sig. gen., 370-560 Mcs, $75, or swap equal value. G. H. Goldstone, 25416 Parkwood, Huntington Woods, Mich.

FOR SALE — Used, reconditioned, two-way mobile units, base and mobile on 30-50, 148-172, 450-470 megs., and Crystal controlled monitoring rcvrs., 117 VAC, 12-6 VAC, l. n. Shirdan Corp., 625 Van Houten Ave., Clifton, N. J.

SELL OR SWAP — 250 watt ham rig S40 rcvr. W. H. Allen, 4313 E. Grant Rd., Tucson, Ariz.

FOR SALE — Bell & Howell E 179 projector, 16 mm sound on film. Cost $595, sell for $300 FOB. E. W. King, 1924 Central Ave., Kearney, Neb.

TRADE — German camera (120 film b & w or color); fast F.4.5 Anastigmat lens for any kind of test equip., or TV set. Wurm's Radio-TV, 1015 W. Grant St., Appleton, Wis.

SELL OR TRADE — Have Hi-Fi amplifiers, changers, speakers, Rek-O-Kut disc recording equip., misc. parts. Want amateur rcvr. and xmitting equip. Raymond Shelton, 858 Arnett Blvd., Danville, Va.

WANTED — 6A5G vacuum tubes. State cond., quantity and price. Jacob B. Pesek, 369 Huntington Lane, Elmhurst, Ill.

SELL — Alliance VHF TV converter, $10; 30 w. modulator for Adventurer or AT-1, $15, with mike; 35" enclosed rack cabinet, $10. Everett Ellsworth, 325 Nassau, Park Forest, Ill.

TRADE — Heathkit A-9C 20 w. amplifier, excellent cond., for 2-speed tape recorder. RCA transcription arm, $15. William Brasie, 714 Willow Springs Dr., Owosso, Mich.

FOR SALE — Bogen variable speed 17-80 rpm record player, mag. cartidge, $24.50; Pentron 3 PMC tape deck, HF 1A recording playback pre amp with meter, case, $69.95. J. C. Davis, 5444 West Keeney Ave., Morton Grove, Ill.

WANTED — Instruction book or circuit diagram for Model CE Capacitor Analyzer, Solar Mfg. Co. Advise price. John L. Pogue, 71 Spencer Road, Rochester 9, N. Y.

SWAP — Safeguard check writer, and Remington-Rand adding machine, both l. n., for Sams folders, on value-for-value basis. Jack Johnson, 416 Duke St., Morgan City, La.

WANTED — Good communications rcvr. with BC band, cash or have Rolleiflex 4 x 4 cm camera f 3.5 Tessar lens, or electronics lab. equip. M. Hoberman, 11 Godwin Ave., Fairlawn, N. J.

FOR SALE — Superior TV40 picture tube tester in perfect cond., $12. William M. Cooper, 700 E. 2nd. St., Siler City, N. C.

FOR SALE — Heath AR-3 rcvr. with cabinet, perfect, one year old, completely aligned, $34.95 FOB. Fred Dawson, 92 Allen Av., Cranston 10, R. I.

SWAP — Need good portable transistor radio, or used TV. Have Archer pickup to convert Spanish guitar. Dan Bruno, 28 South Bow St., Milford, Mass.

SELL OR SWAP — E200C Precision sig. gen. and 21 Mc. standard tuner, both l. n. O. Zetlmeier, 1123 Woodycrest Ave., New York 52, N. Y.

SELL OR TRADE — GE marker and sweep gen. ST5A and ST4A; Hickok 650 Video gen. Want ham equip. L. C. Brookbank, 7716 Aucupulco Rd., El Paso, Tex.

WANTED — Late TV course; 16 WP4 tube in working cond. for cash, or trade 16 GP4. State cond. and price. Have old style tubes to sell. Petersen Radio, Palmer, Iowa.

FOR SALE — Heavy-duty enclosed relay racks, unused, 72", 200 lbs., $45; Par-Metal enclosed racks 82¼", apx. 110 lbs, $20; UTC S-12 xformers, $1.50. Bill Watson, 96-01 133 Ave., Ozone Park 17, N. Y.

TRADE OR SELL — Eico 425 scope, needs 5BP-1; Simpson VOM. Want communications rcvr., tape recorder, code oscillator. J. Munson, Front St., Pembroke, Maine.

FOR SALE — 6 University reflex loud speakers, PH horn, SA-HF drivers, $25 each; University 4A4 super power spkr. with drivers, $90. Western Radio Repair Shop, 2 E. William St., Bath, N. Y.

FOR SALE — Arkay FM-AM tuner, FM needs some repair, $20; Eico 425 scope, $50. Any electronic kit expertly wired. Irving Rosenthal, 53-05 92nd St., Elmhurst 73, L. I., N. Y.

FOR SALE — 8" electric stove Cromolox AT92G, 230-240 v., 2100 watts unit. Made by E. C. Weigand, Pittsburgh, $8. Radio Shop, 4855 W. Ohio St., Chicago, Ill.

FOR SALE — 50-BC 645's, with dynamotors. F. Brechlin, Eau Claire Vocational School, Eau Claire, Wis.

FOR SALE — Fischer scientific powerhouse cat. No. 9-518, for $85, valued at $190. Delivery in Pittsburgh and vicinity only. Mrs. Thomas Wilson, Gen. Del., New P. O. Bldg., Pittsburgh, Pa.

SELL OR TRADE — ONAN 5GO generating plant for HRO-60, 75A-4, or cash. Bob Marie, Box 30, Springport, Ind.

WANTED — NRI course in practical technical training in Radio & TV & Allied Electronics, complete. Doug Harris, 6023 Loomis St., Lakewood, Calif.

FOR SALE — Supreme 571 sig. gen. in perfect cond.; and model 504-A (portable lab.) recently modernized to test newest tubes. Need little repair. H. Elliott, Fontana, N. C.

FOR SALE — 6-band 150 w. RF amplifier from June '49 QST, uses push-pull 807's with 6Y6G clamp tube and National MB40L and MB150 tuning assemblies, $20. Frank Seaverns, 9190 Ogden St., Thornton, Colo.

FOR SALE — Emerson portable TV-Radio, $60. Local only. Paul Davis, 141-21-78 Rd., Flushing 67, N. Y.

WANT for cash — Diagram and pictorial of models FC-1K or 301 tube tester kits. Name price. Space Electronics, 131 Stratford Dr., Houghton Lake 12, Mich.

FOR SALE — Complete radio station, Hallicrafter S40A rcvr. with SM40 external meter, Eldico TR 75 TV, with AM40 modulator, Eldico tubeless VFO, Lysco ant. coupler, Shure hi-imp. dyn. broadcast mike, $150. Joseph Lucca, 221-37-113 Dr., Queens Village 29, N. Y.

SELL — 1957 Chevrolet transistor push-button and 1956 Cadillac signal seeking radios, and others; sensitive research AV polyranger 0-1000 v., 0-3 A AC-DC radio chassis. Want tape recorder, 6-12 v. battery eliminator. S. Martin, 722 Pennsylvania Ave, Elizabeth, N. J.

SELL OR TRADE — Transmitting experimental kits from NRI Radio Operating course. Local only. Sidney Goldstein, 2129 76 St., Brooklyn 14, N. Y.

WANTED — RCA Pict-O-Guide vol. II. L. Mick, 202 N. Peoria Ave., Dixon, Ill.

SWAP — C-D Capacitor analyzer for microscope. Joseph Plass, 65-83-160 St., Flushing 65, L. I., N. Y.

FOR SALE — 3 variable condensers; 3 speakers; 2 diode crystals; 2 switches; Single headphone 1000 ohm; single earphone approx. 500 ohm; 8 good used radio tubes; 9 "Popular Mechanics" 1955. Best offer. H. Dean Pippin, Atlanta, Mo.

TRADE — Sams and Riders for good 35 mm camera and projector. R. M. Sadler, 3616 E. 35, Kansas City, Mo.

FOR SALE — Superior TC55 tube tester and RMS bar gen., both $15. Robert Fellows, 16 Philmore Ave., Caledonia, N. Y.

SELL OR TRADE — RCA amplifier and 12" speaker, MI. 12222B; 3 small radios; Weston 772 VOM; analyzer without case. Swap for binoculars or camera. H. Y. Itnoller, 1590 E. 22nd St., Brooklyn 10, N. Y.

WANTED — Handle and 1/4" socket for Pacemaker Premium tool set. Screw driver handle is changeable. Or would like address of manufacturer. W. I. Williams, 949 East Broadway, Phoenix, Ariz.

WANTED — Hallicrafters SX62 or SX42 rcvr. State cond. and lowest cash price. David Stroup, E. 2428 Everett, Spokane 28, Wash.

FOR SALE — Electronic business, building, and adjacent home, est. 1943, $32,000 — 1/3 down. Jack Mayr, 818 Salem St., Chico, Calif.

FOR SALE — 10 and 20 meter coils for Hallicrafter HT-9 xmitter, $5 each. J. Endlich, 759 Brooke Circle, Morton, Pa.

FOR SALE — BC-312 rcvr. without power supply. As is, best offer over $40. Rick Schrier, W. 2203 Jackson, Spokane 12, Wash.

SELL OR SWAP — Field strength meter, Supreme TV manuals, other gear for photo equip. or citizens band transceivers. J. T. Self, Box 8151, Asheville, N. C.

SWAP — 3" scope, needs rework for photographic equip. line. Interested in small portable radios, need not be in working order. S. J. Lo Nigro, 14 Madeline Ave., Clifton, N. J.

FOR SALE — Hardly used NRI test instruments: 33 sig. tracer; 68 tube tester; 112 RC tester; 88 sig. gen. Best offer. E. A. Bernstein, Central YMCA, Box 65, Harrisburg, Pa.

WANTED — Service manual or complete alignment information for Navy type ARB rcvr. D. L. Prescott, 23 Stoneybrook Ave., San Francisco 12, Calif.

WANT — Good used Heath AT-1 xmitter, also bug. State price and cond. Joe Capell, Jr., 4329 Iowa Ave., Fresno 2, Calif.

FOR SALE — BRX-2 Berlant broadcast recorder, 1. n., $395; Garrard 301 turntable, $60; Pickering Fluxvalve-Unipoise pick-up arm, unused, $45; GE transcription arm with mag. cartridge, $17. Jeanne LiCalzi, Greenwich, N. J.

SELL OR TRADE — Alliance rotor; Bogan 6C intercom; 6 to 110 v. inverter; xformer 1.100 Ratio. Make offer or will trade any for tropical fish supplies. George Ledoux, 23 Walker Rd., New Britain, Conn.

TRADE OR SELL — Slightly used Knight in-circuit capacitor checker and Eico M-352K bar gen. Completely wired and tested. Edward C. Stask, 400 W. Cherry St., Shenandoah, Pa.

WANTED — Tube tester. Must be in good cond. and reasonable. C. B. Tanner, 1161 Gordon St., SW, Atlanta 10, Ga.

WANTED — Pair of 4-400 trans. tubes, four 872 rect. tubes, four 500 MA filter chokes, 12 MFD filter cap. for 3000 v. Describe and state price. K. K. Miller, Box 65, Groton, Conn.

FOR SALE — Deluxe model 315 sig. gen., tuned with Precision instrument, $30 plus shipping. Leon A. Martinez, 3603 W. Commerce St., San Antonio 7, Tex.

FOR SALE — 12 motel radios, blonde nite-stand type, AC, rugged construction, with 25c per hour timers, good tone, $7.50 each, special price for dozen FOB. R. Sheehan, 628 S. Bel Aire Dr., Burbank, Calif.

FOR SALE — Lysco 600 xmitter, TVI surpressed, clean cond., operates perfectly and model 50 antenna coupler, $60 for both. L. M. McGee, 501 E. Wyatt, Herington, Kan.

WANT — Bendix radio cabinet ivory table model 111W. State price. J. Komarniski, Scobey, Mont.

FOR SALE — NRI Radio & TV course with all information, good cond., $20, no kits. Garvis McKeen, 109 Mallory Dr., LaGrange, Ga.

SELL OR TRADE — BC-1068-A, converts to 2 m. band, 150-200 Mcs.; Morrow mobile rcvr. MBR-5, FTR comb. Need Collins 75-A2. Walter B. Boyer, Box 124, Liberty Lake, Wash.

WANTED — Aircraft-Military-Airline electronic equip., all types. R. L. Ritter, Box 156, Annandale, Va.

WANT — Field strength meter; speaker driver unit; small TV; NRI or similar appliance repair course; TV testing equip. Pleasant Valley Radio Service, Box 376, Armstrong, B. C.

SWAP — Thordarson choke 12 Hy. T-15C47-400 MA and power transformer 400 MA 500-0-500; signaling transformer Jefferson Elect. 4-24 volts for guns. W. Zinsmeister, 146 N. 16th St., Bloomfield, N. J.

SELL OR TRADE — Large stock of casting spinning fishing lures, custom made, types for bass, etc. Want scope; capacitor bridge; VOM; or sig. tracer. Charles Andrews, 175 Brookridge Dr., Rochester 16, N. Y.

SELL OR SWAP — German tubes, parts, and literature for short-wave equip. and technical literature. Gerhard Kensy, c-o Philips, Berlin-Mariendorf, Ullsteinstr. 67, Germany.

FOR SALE — Coyne 1-5, $12; Heath V7A VTVM; SGA sig. gen.; Mallory 6RS10 elim.; T-3 tracer, $21 each; 010 5" scope, $44; Hallicrafter S-38, $25; 5R10A, $26; 12 v., 150 w. Delco light plant, $60. C. Deuble, 3246 Baseline Rd., Grand Island, N. Y.

WANTED — Wireless microphone "Microvox"; small broadcast rcvr. with short-wave switch made in 1930's or 40's. L. Menzie, 22-43 35th St., Astoria 5, N. Y.

FOR SALE — National HRO 50T1 rcvr., with new tubes and all coils, in A-1 cond., $199.50; relay rack with all aluminum panels and chassis, 24" wide 76" high, best offer. Norman Inventasch, 320 E. 176 St., New York 57, N. Y.

FOR SALE — Radios, test equip, TV sets in good cond. Write for list. Brian Chin King, 22 Mulberry St., New York 13, N. Y.

SWAP — 2 National precision worm dials; Argus 35 mm camera for American Flyer S guage switches, etc. A. A. Fazakas, 116 Fourth Ave, East Orange, N. J.

EMPLOYMENT WANTED — Instrumentation, electronics technician; mechanical, hydraulics, architectural, electrical, electronics (printed CKT) detail draftsman. Permanently relocate in Colorado. Resume or gov't form 57. Salary open. R. L. Scott, 10493-129th Ave. No., Largo, Fla.

SWAP — Heath 7 w. amplifier with preamp; lab-type sig. gen., with all test leads, cost over $90. All excellent cond. Trade for Hi-Fi equip. or cash. Herbert Piller, 268 E. 45 St., Brooklyn 3, N. Y.

TRADE — $97.40 Kodak Tourest never used Anister 101 mm f/4.5 four element lumenized lens. 1 to 1/800 shutter $8.50 case for Hickok tube tester: 6000, 6005, 750, 600A, 539B, Triplett 3423 or Simpson 1000. Orris Book, R 6, Box 133, New Castle, Pa.

SELL OR TRADE — Converted ARC-4, with 12VD dynamotor, rcvr. and xmitter on 2 meters, xmitter about 15 w., $25. Want AR-22 rotor or 10 meter cubical quad. Will ship, check or money order, no cash. Robert W. Cooper, 1006 N. Edinburgh Ave., Los Angeles 46, Calif.

FOR SALE — Revere T10 tape recorder, 7½ ips, new cond., $100. Charles A. Schmitz, 4737 Matilda Ave., Bronx 70, N. Y.

FOR SALE — 400 w. xmitter with 10-20-40-80 meter coils, phone and CW, TVI'd 400B Globe King, Lysco 600 TVI'd, HQ 129X with speaker. Make offer, FOB. J. Stansberry, Box 108, Clinton, Iowa.

WANTED — 120 w. modulator for 807's final. George Leininger, 16412 Marquis Ave., Cleveland 11, Ohio.

SELL OR TRADE — Complete Zenith transistor Royal hearing aid, batteries, perfect working cond. For cash or ham rig(phone multi band) plus cash. Mike Yacenick, 105 Elm Dr., Trafford, Pa.

FOR SALE — NRI courses, radio-TV and comunications, with servicing booklets (no kits), 122 booklets plus VTVM, $25 or best offer, plus postage. J. D. Grigas, 258 Coe Rd., Clarendon Hills, Ill.

SELL OR TRADE — BC-603D, 20-28 Mc; TCS-13, 1.5-12 Mc; BC-659, 28-39 Mc. All in exc. cond., with 12 v. pwr. supplies. Trade for 5" scope. Melvin Weimeister, Beach Mobile Home Pk., Lot 26, Zion, Ill.

FOR SALE — 1000 ma. 115 v. power supply for electromagnet 110/220 VAC input — DC output for cash. August Luedtke, Lomira, Wis.

SWAP — Ampro 731 tape recorder for small printing press, tools, or what have you? L. Benedict, Bath 2, Pa.

WANTED — 15 and 6 meter beams. Will trade 150 w. trans. or pay cash. Scott Hartman, 3029 Cavenish Dr., Los Angeles 64, Calif.

FOR SALE — Sonar SR9 SW rcvr., 144 to 160 Mc. used twice, $25 or best offer. Frank Tarantino, 16 67th Ave., Newark 4, N. J.

FOR SALE — 50 w Viking Adventurer, 1. n., professionally wired, $52, with home brew VFO, $60. Sell or trade Carter magmotor MVS 415 6 v in 400 VDC out @ 150 ma. for $19 or antenna rotator. Raymond Wilton, 4 Liana St., Woburn, Mass.

TRADE — BC 221 freq meter with AC power supply, calibration book and extra case, $85 or Hi-Fi equip. No kits. Precision Service Co., 937 Center St., Brockton 58, Mass.

WANTED — CBS Transistor home study course, PA-175. Give price. E. N. Christner, 313 Crawford St., Middletown, Ohio.

WANTED — Dumont or other Mallory type continuous TV tuner. Must be untampered, 21 Mc IF. John Childs, Jr., Box 32, Dahlgren, Va.

FOR SALE — Gonset 10 meter converter; Carter dynamotor; 10 meter Subraco xmitter. W. Printz, 1177 East 14 St., Brooklyn 30, N. Y.

FOR SALE — Complete 300 w. AM-SSB station: 10A, 2 VFO's, Meissner 150B, NC-173, Q-mul., slicer, $500. J. Taylor, Stanwood Rd., Mt. Kisco, N. Y.

SELL OR TRADE — Palomar Junior, 4¼" reflector, perfect cond, two eyepieces for Hallicrafters S-53A, SX-99, S-85, SX-101 or $75. Myles Margady, 2043 74 St., Brooklyn 4, N. Y.

FOR SALE — National NC-98 communications rcvr. with matching speaker, new cond. with original instructions and packing, $100. Russell Ransom, Jr., Box 4927, Duke Sta., Durham, N. C.

FOR SALE — Heath sweep and marker gen., TS-4A, excellent cond. and operation, $50. A. Kramer, 340 East 184 St., New York 58, N. Y.

WANTED — National Criterion FM-AM tuner in good cond. J. Weissner 72 Truesdale Dr., Croton-On-Hudson, N. Y.

FOR SALE — Ballantine 300 VTVM in excellent cond., instruction manual, $90 FOB. H. Slade, 23 Francis Ave., Cambridge 38, Mass.

WANTED — Western Electric tubes. Types WE: 321A, 357B, and 5541. State price and quantity available. F. Gollub, 1866 Watson Rd., Abington, Pa.

WANTED — Monitoradio MS-119 squelch adapter used in Monitoradio M-101 mobile HF FM rcvr. James McDaniel, 1013 Lafayette St., Elizabeth, N. J.

FOR SALE — USCG L-115 rcvr., $50; BC-459A ECO, misc., meters, test equip. and pwr supplies, radio-TV books. Selling out. Henry Mirtic, 5406 Spencer Ave., Cleveland 3, Ohio.

WANTED — FM-AM tuner; Hi-Fi amplifier; transistor pocket radio; pocket size FM radio. Oliver Zucco, Granite Ave. Ext., Canaan, Conn.

FOR SALE — Antique meters by GE: 0-150 VDC wood case 8 x 8 x 4½" good cond., 1923, Thomson alternating ammeter wood case 7 x 7 x 4½ l. n., 1913. Best offer. John H. Robishaw, 6 Mt. Pleasant Ave., Ipswich, Mass.

FOR SALE — Hammarlund SP400X rcvr., power-supply and speaker, $250; 4 x 5 Speed Graphic camera, 3.5 Schneider Xenar lens, Compur shutter, film-pack adapter, 6 cut-film holders, tripod, $150; RCA 16 mm sound projector and speaker, $175. Will send photo of equipment. Paul G. Moore, 461 E. Okaloosa Rd., Ft. Walton, Fla.

STOLEN — Crestwood 404 tape recorder, l. n., Ser. No. 40401554 on Jan. 18, 1958, in Baltimore, Md. Please notify Theodore Thalis, 675 4 Ave., Brooklyn 32, N. Y.

FOR SALE — Gonset 6 meter converter, $35; Supreme audolyzer, $40; short wave tuner .15 to 12 Mc., $55 covers ship to shore 75.80 meter, 40 meter phone and radio beacons. R. W. Hastings, 7789 LaHabra Cir., Buena Park, Calif.

WANTED — Recent Radio-TV course with or without kits. Pay cash or trade factory tested Heath tube tester, Allied in-circuit cap checker or good VTVM. C. E. Salom, 724 Hunting Tower W, Alexandria, Va.

FOR SALE — Unused Stephens 120 LR woofer, $25; Jensen RP 302 super tweeter, $20, excellent cond. Paul Richter, 1448 Webster Ave., Bronx 56, N. Y.

TRADE — Astatic 4 tube booster in excellent cond. for UHF converter in working order or what have you? Clarence Kelly, 214 W. Market St., Blairsville, Pa.

SELL OR TRADE — Channels 36 UHF stand. coil and 54 UHF tuner strips; large Mallory UHF converter, almost new, in perfect cond. Jim Grevas, 208 Clearpoint Lane, Affton 23, Mo.

WANTED — Sweep gen. or FM tuner in trade for Heathkit PS-2 power supply. Frank R. Leslie, 26 Valleyview Dr., Dayton 5, Ohio.

TRADE — SX-28; needs work, but operates on BC band. Can use TV test equip., audio or 8 mm camera. A. Moore, 209 Manhatten St., Tottenville, Staten Island, N. Y.

FOR SALE — 2 Chevrolet car radios fit 1941 to 1948 dash; 1949 Buick car radio. John Strazza, 48 Pulaski St., Bloomfield, N. J.

WANTED — Eico or other oscilloscope, in any cond., with or without CR tube, also empty 'scope metal case and faceplate. Leon Recht, 430 East 67 St., New York 21, N. Y.

WANTED — RCA model ACR-111 amateur rcvr. in good mechanical cond. Will pay $25 plus express or trade FM tuner, etc. L. R. Mitchell, 4 Sidney St., Greenwood, Mass.

WANTED — Tape recorder, Revere push button or Teltape battery portable. Eugene Kon, 1516 Broadway, Buffalo 12, N. Y.

SELL OR SWAP — 37 UHF channel boards for 32 and 17 boards for channel 20. Sell for tape recorder or sig. and marker gen. to cover latest TV sets. Amtrac Television, 1638 University Ave., Berkeley 3, Calif.

FOR SALE — E. H. Scott Radio Labs., SLR-F rcvr., 80-550 kc. and 1.9-24.0 Mc., $100 or best offer; sig. gen. I-222-A; AR8510 rcvr. 15-650 kc.; BC-1000-A transceiver. H. Pinkwart, 2125 Ricardo Dr., Concord, Calif.

FOR SALE — ATR B-eliminator mod. EL1B, needs some repair, local preferred. Bill's Radio Shop, 703 Adventure St., Beaufort, S. C.

WANTED — For cash or trade RME MC55 amateur band mobile converter. W. L. Sillman, 193 Moffat St., Brooklyn 7, N. Y.

TRADE — Toolmaker and machinist tools, inside mikes, indicator set, depth vernier, 6" inside and outside vernier, and "V" blocks; tape recorder. Want commercial transmitter in 60 to 100 watt class. Theodore A. Smith, 35 Meredith St., Springfield 8, Mass.

FOR SALE — Hallicrafters S94 police patrol rcvr., 30 to 50 Mc; 777 sig. tracer; 77A VOM, all in perfect cond. H. H. Riley, R 4, Box 346, Aiken, S. C.

FOR SALE — Rider's TV manuals, 5, 6, and 7, $15 each, including TV, How It Works and index. Walter B. Zimny, 313 Grant St., Boonton, N. J.

FOR SALE — Hickok 191X microvolter, $45; Jackson TV-2 sweep marker gen., $145, both in A-1 cond. Val Obal, 4165 J St., Omaha 7, Neb.

WANTED — RCA audio chanalyst with instructions. State cond. and price. O. H. Sandman, 1404 N. Glendale St., Peoria 3, Ill.

SELL OR SWAP — DM53A dynamotor 0-6 v meter; 12 asstd. transmitting type conds, 600 v to 2500 v; Electrical Engineer Handbook; 18 crystals for 10 meters 28 Mc to 29.7 Mc; 12 v relays. Want scope, tape rec., or good rcvr. F. Warsalla, 1506 Oak St., Port Huron, Mich.

FOR SALE — Solar CF exameter resistor-capacitor analyzer and VTVM with manual, $40. David Ecklein, 2009 Oakland Ave., Cedar Falls, Iowa.

FOR SALE — 5" radar or scope pix tubes with adapter to work as test tube for TV sets, $4.50 plus postage; Mighty Match for using two antennas with one lead-in wire, 10c each. John Petillo, 403 N. Main Ave., Scranton 4, Pa.

WANTED — Mobile converters covering 40-50 Mc, FM, or covering marine frequencies below 500 kcs, both for 6-12 v. operation. Bob Love, 144 Whitford Ave., Nutley 10, N. J.

SELL OR TRADE — 7JP4 and 14" CR tubes, Regency UHF tuner, 1T4, 1R5, 3S4, 5V4 tubes, TV type electrolytic condensers, 1. n. Want photographic equip. or cameras. W. N. Baer, 741 State, Lancaster, Pa.

SWAP — Professional 2-unit portable Presto disc recorder, amplifier, accessories and RCA pre-amp, for cash or better type tape recorder. D. Karpilow, 1910 Elizabeth St., San Carlos, Calif.

SWAP — "How To Run A Lathe" by South Bend Lathe Works, never used, for Sylvania's "How To Use Oscilloscope". J. Radom, c-o Stephen A. Halsey J. H. S., Forest Hills, N. Y.

SELL OR TRADE — Aircraft band radio rcvr., $10; Trav-Electric converter 6-110 v., $10; Feiler sig. tracing analyzer, $15. Robert Gelnett, R 2, Liverpool, Pa.

FOR SALE — Leece-Neville 6 v. 60 amp. alternator with rectifier, 60 amp. meter, 100 amp. regulator; GE 1/4 hp continuous duty 110 VAC motor in "U" cradle, $6. Donald Pope, 26 Virginia Rd., Arlington, Mass.

WANTED — Good, used multiband short-wave converter for auto; also good, used tape recorder. William Paul, 8 Laurel St., Boston 19, Mass.

SELL OR TRADE — B and H Master, 16 mm sound projector, record changer, record player, 78 rpm, speakers. Jack Grant, Box 281, Coalgate, Okla.

WANTED — Original power transformer from discarded Clarion 5-tube superheterodyne 320 radio, uses tubes 80, 47, 58, and two 57's, made by Transformer Corp. of America. State cond. and price. Ovie B. Ball, R 3, Connersville, Ind.

SELL OR TRADE — RCA WV87A master volt ohmyst 1. n., $100; Simpson 260 meter, $25; Heathkit TS1A sweep and marker gen., $25; NRI 88 sig. gen., $25; Trav-Elec 61160 converter, $10; Eico 584 battery tester, $7.50. Walter E. Niemiec, 227 Fairway Dr., New Hartford, N. Y.

TRADE — Unused Navy aircraft radio RU-18 12 to 14 VDC with dynamotor, frequency range 195-13,575 Kc, no cables. Want binoculars, movie camera or projector. Merle Henske, 505 Dayton St., Omak, Wash.

SWAP — 2 high quality watches, for test instruments. G. Dukhov, 605 West 137th St., Apt. 53, New York, N. Y.

WANTED — Channel selector tuner for AMC TV model 54 CL021. Carl Marshall, 111 Edgar Ave., Dayton 10, Ohio.

SELL OR TRADE — 3 Bendix synchro differentials (Selsyns) 110 AC v.; RCA UHF tuner model U70, 1. n. Joe's TV Service, 1333 Sunset Rd., Cleveland 24, Ohio.

FOR SALE — Photofacts in envelopes, 81 thru 149, misc. sets nos. 79, 126, 158, 159, 181, 184, 187, 191, 197. All in good cond., 80 cents per set prepaid. H. E. Claar, Box 174, New Baden, Ill.

TRADE — Almost new $100 Raytheon, outdoor electric sign, for photo enlarger. Gene Tozier, 4415 Tyler St., Sioux City 6, Iowa.

FOR SALE — 2 Refrigeration books by Althouse and Turnquist, $2 each; Air Conditioning book by Brown, $3; different types of tools. John Holiday, R 2, Box 100, Indiana, Pa.

FOR SALE — WE 215A polar relay, cased, $3; 3 W.U. polar relays @ $1.50. Want schematic for 6-12 v. R/C modulated transistor transmitter and companion transistor 117V rcvr., 27.255 Mc. J. M. Hirschinger, 417 Hampshire St., Quincy, Ill.

FOR SALE — Heath tube checker with TV picture tube tester, 1. n., $25; unused dynamic conductance tube and transistor tester, factory tested, $75. H. Opel, Box 316, Melbourne, Ky.

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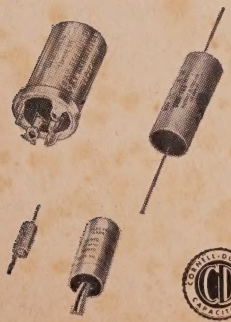

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